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Lead-Based Paint Abatement and Repair and Maintenance Study in Baltimore: Findings Based on the First Year of Follow-up

Executive Summary

In recent years, there has been growing interest in the use of interim measures to temporarily control the problem of extensive residential lead-based paint hazards in U.S. housing in a cost-effective manner. Title X of the Housing and Community Development Act of 1992 (P.L. 102-550) defined interim controls as " a set of measures designed to reduce temporarily human exposure or likely exposure to lead-based paint hazards, including specialized cleaning, repairs, maintenance, painting, temporary containment, ongoing monitoring of lead-based paint hazards or potential hazards and the establishment of management and resident education programs." The 1995 HUD *Guidelines for the Evaluation and Control of Lead-Based Paint Hazards in Housing* provide detailed information on interim control practices. However, little is known about the short-and long-term effectiveness of these approaches in terms of reducing lead in dust and in children's blood.

This report presents the first year of follow-up of the Lead-Based Paint Abatement and Repair & Maintenance (R&M) Study in Baltimore. The study is designed to characterize and compare the short-term (two to six months) and longer-term (12-24 months) effectiveness of three levels of interim control interventions (R&M I-III) in low-income housing where children are at high risk of exposure to lead in dust and paint. The study has two control groups -- urban houses built after 1979, and presumably free of lead-based paint, and previously abated houses that received comprehensive abatement in the past. The study population consists of non-Hispanic black households with at least one participating child. At the outset, mean ages of study children ranged from 25 months to 33 months across groups, and their geometric mean blood lead concentrations were 10 µg/dL in R&M I, 14 µg/dL R&M II, 14 µg/dL in R&M III, and 13 µg/dL in the previously abated houses. The geometric mean blood lead concentration in children in the modern urban houses was 5 µg/dL, a value close to the geometric mean for U.S. children 12 months to 60 months of age.

During the first year of follow-up, objectives related to enrollment, laboratory performance, data quality and data completeness were met. Furthermore, families were informed by letter of the results of dust lead and blood lead tests from each campaign. For this reason, the study intervention was a combination of R&M work and the provision of information to families on a periodic basis. The main findings based on dust lead and blood lead data from the five study groups collected during the pre- and post-intervention campaigns, as well as during the two, six and 12 months post-intervention data collection campaigns are summarized below.

- All three levels of R&M intervention were associated with statistically significant reductions in house dust lead loadings and with total dust loadings that were sustained below pre-intervention levels during the first year of follow-up. Dust lead concentrations were significantly reduced following intervention in the middle (R&M II) and high (R&M III) intervention houses, but not in the low intervention houses (R&M I).

- The dust lead loadings, lead concentrations, and dust loadings during the first year of follow-up were related to the intensity of the intervention. Immediately following intervention and at two months, six months, and 12 months post-intervention, dust lead loadings, lead concentrations and dust loadings were lowest in R&M III houses, intermediate in R&M II houses, and highest in R&M I houses. Statistically significant differences were found between R&M groups on these dust measures over time. For example, at 12 months post-intervention, weighted average dust lead loading estimates were 21-fold higher in R&M I houses than in R&M III houses, and five-fold higher in R&M I houses than in R&M II houses.

- The modern urban control group had significantly lower dust lead loadings and concentrations across time than the other four groups. These houses, located in clusters of urban houses built after 1979, were expected to reflect the lowest residential and ambient lead levels in the urban environment. Low dust lead concentrations (geometric mean 310 µg/g, equivalent to 0.03 percent) and soil lead concentrations (geometric mean 75 µg/g) support the presumption the these houses were free of lead-based paints. Dust lead levels in the previously abated control houses three years to five years post-abatement were generally intermediate between those in R&M II and R&M III houses at the end of the first year of follow-up.

- At the end of the first year, the unadjusted geometric mean blood lead concentrations were lower for each group -- 8 µg/dL in R&M I, 11 µg/dL in R&M II, and 12 µg/dL in R&M III, 12 µg/dL in previously abated, and 3 µg/dL in modern urban. Children in the modern urban group had significantly lower blood lead concentrations over time, compared with each of the other four groups; their blood lead concentrations were 10 g/dL, the Center for Disease Control's level of concern.

- Using all five study groups in the longitudinal data analysis, a statistically significant

relationship was found between a composite measure of house dust lead in an entire house (both concentration and loading) and children's blood lead concentration, controlling for covariates including age and season.

- Children with pre-intervention blood lead concentrations 20 µg/dL had statistically significant reductions in blood lead concentration during follow-up, controlling for age and season. Statistically significant blood lead changes were not found in children in the three R&M groups with pre-intervention blood lead concentrations<20 µg/dL, again controlling for age and season. Cumulative body lead burden and neighborhood housing characteristics are discussed as two factors that may have mediated children's blood lead responses to the R&M interventions and contributed to the differences in blood lead concentrations observed between children in the modern urban group and those in the other four groups.

The next report will investigate changes in blood lead and dust lead during the second year of follow-up. It should be emphasized that the R&M interventions under investigation are interim control or partial abatement approaches to reducing lead-based paint hazards. As such, they are not expected to be as long-lasting as comprehensive abatement. During the first year of follow-up, none of the interventions in individual houses failed, that is, all or most of the dust samples showed lead loadings at, or below, pre-intervention levels. Thus, a major study objective with important policy implications remains the documentation of the longevity of the R&M interventions. It is also important to note that the costs of the interventions in this project may not be generalizable to other settings and time periods.